Search Feedipedia Search

Automatic translation

Anglais

Feed categories

All feeds
drilling plants
- Cereal and grass forages
- Legume forages
- Forage trees
- Aquatic plants
- Other forage plants

Plant products/by-products
- Cereal grains and by-products
- Legume seeds and by-products
- Oil plants and by-products
- Fruits and by-products
- Roots, tubers and by-products
- Sugar processing by-products
- Plant oils and fats
- Other plant by-products

Feeds of animal origin
- Animal by-products
- Dairy products/by-products
- Animal fats and oils
- Insects

Other feeds
- Minerals
- Other products

Latin names

Plant and animal families
Plant and animal species

Resources

Broadening horizons
Literature search
Image search
Glossary
External resources
- Literature databases
- Feeds and plants databases
- Organisations & networks
- Books
- Journals

Chickpea (Cicer arietinum)

Description | Nutritional aspects | Nutritional tables | References

Click on the "Nutritional aspects" tab for recommendations for ruminants, pigs, poultry, rabbits, horses, fish and crustaceans






Common names

Chickpea, chick pea, Egyptian bean, gram pea, Bengal gram [English]; garbanzo [Spanish]; pois chiche [French]; grão-de-bico, ervilha-de-bengala [Portuguese]; kikkererwt [Dutch]; Kichererbse [German]; kacang arab [Indonesian]; cece [Italian]; nohut [Turkish]; Đậu gà [Vietnamese]; [Amharic]; الحِمَص [Arabic]; [Bengali]; 鹰嘴豆 [Chinese]; نخود [Farsi]; Ρεβιθιά [Greek]; [Gujarati]; חמצה [Hebrew]; [Hindi]; ヒヨコマメ [Japanese]; Нут [Russian]; [Tamil]; ถั่วลูกไก่ [Thai]; چنا [Urdu]

- Chickpea seeds, chickpeas, desi, kabuli
- Chickpea bran, chickpea chuni
- Chickpea pod husks
- Chickpea straw

Species

Cicer arietinum L. [Fabaceae]

Feed categories

- Legume forages
- Legume seeds and by-products
- Plant products and by-products
- drilling plants

Related feed(s)

Description

The chickpea (*Cicer arietinum* L.) is a major grain legume cultivated for its edible seeds in the Mediterranean Basin, Asia and Australia. The plant is quick-growing, branched, and reaches a height between 20 and 60 cm, even up to 1 m. It has a deep taproot, down to 2 m, and many lateral secondary roots exploring the upper layers (15-30 cm) of the soil. The stems are hairy, simple or branched, straight or bent. Leaves are 5 cm long with 10 to 20 sessile, ovate to elliptical leaflets. Chickpea flowers are white, pink to purplish or blue, typically papillonaceous and solitary. The pod is pubescent, inflated and oblong, with 2 or 3 seeds. The seeds are variable in size (5 to 10 mm in diameter), shape (spherical to angular) and colour (creamy-white to black) (Ecoport, 2013; Bejiga et al., 2006; van der Maesen, 1989). *Cicer arietinum* is the only cultivated species among the 43 species of the *Cicer* genus. There are no less than 40,000 accessions in the world. Cultivated chickpeas are divided into 2 main groups, the Desi and the Kabuli groups. Desi seeds are small, darker coloured and smooth or wrinkled. Kabuli seeds are larger and cream-coloured. Kabuli seeds contain less fibre and cook faster than Desi seeds and are thus more desirable for food. Desi chickpeas are bushy plants with relatively small leaflets and flowers, with purplish anthocyanin pigments in their stems and blue-violet flowers, and are primarily grown in Southern Asia and Ethiopia. Kabuli types have erect growth and white flowers, and are grown in the Mediterranean region (Bejiga et al., 2006).

Chickpea is a multipurpose grain legume widely used around the world, notably as a source of protein (Bejiga et al., 2006). Chickpea seeds of the Desi type are generally consumed as a dry pulse, whole, split, or ground as dhal or flour, and in sauces such as hummus or soups (Bejiga et al., 2006; van der Maesen, 1989). Kabuli types are used for salads, vegetable mixes and can be canned. The seeds and the pods can be consumed fresh. Chickpeas may also be roasted, salted and consumed as snacks (Bejiga et al., 2006).

Several by-products of chickpea cultivation and processing are used for animal feeding, including low-grade and culled chickpeas, bran (a by-product of dehulling, known as chuni in India), crop residues (husks, straw) and chickpea hay (Taylor et al., 2007; Bejiga et al., 2006). However, even though its nutritional characteristics are similar to those of other important grain legumes such as field pea, chickpea is less used in animal feeding (Bampidis et al., 2009). The straw and dried roots of chickpea are used as fuel for cooking. Chickpea starch is suitable for textile sizing and in the manufacture of plywood (Bejiga et al., 2006). The leaves yield an indigo-like dye and have uses in traditional medicine (Taylor et al., 2007).

Distribution

Chickpea is a cool-season grain legume that may withstand hot temperatures during fruiting and ripening (Ecoport, 2013). It is thought to have originated in South-East Anatolia and neighbouring Syria and Iran, where the earliest remains date back to around 7000 BC. It was introduced to the Mediterranean Basin, Africa and the Indian subcontinent before 2000 BC. *Cicer arietinum* grows from sea level up to an altitude of 2500 m in areas where temperatures ranges from 15°C to 29°C (van der Maesen, 1989). Chickpeas are mainly cultivated in the cool, dry season of the semi-arid tropics on residual moisture. The plant is well adapted to tropical climates with moderate temperatures and is successfully cultivated under irrigation in the cool season of many tropical countries (Bejiga et al., 2006). It can benefit from spring rains provided that the soil is well-drained. Well-aerated sandy to sandy loam soils and black cotton soils with a pH ranging from 5 to 7, or even higher, are suitable but salinity and sodicity should be avoided (Ecoport, 2013; van der Maesen, 1989). Chickpea can grow in places where annual rainfall ranges from 500 to 1800 mm (Bejiga et al., 2006). It is tolerant of drought but does not withstand the humid and hot lowland tropics. Rainstorms during flowering, which may occur during the monsoon season, may harm the crop that is then used mainly for fodder (van der Maesen, 1989). Early summer heat or frost during flowering may also hamper crop yield (Ecoport, 2013).

Chickpea seed production has been increasing since the 1990s and rose from 7 million t in 1990 to 11 million t in 2012 (FAO, 2013). This increase is mainly due to better yields, which reached about 0.9 t/ha worldwide in 2011. The main chickpea producers are India, Australia, Pakistan, Turkey, Myanmar, Ethiopia, Iran, the USA and Canada (FAO, 2013; ICRISAT, 2013). The international trade in chickpea is relatively limited and concerns only 10% of total production (FAO, 2013).

drilling management

Chickpea can be broadcast or sown in rows (25-30 cm inter-row spacing and 10-30 cm between seeds within rows). Seedlings are sensitive to weeds during the first 4-6 weeks of growth and should be mechanically weeded. Chickpea can be grown as a sole crop or intercropped with linseed, sorghum and other crops. It can also be grown in rotation with flax, sorghum, teff (*Eragrostis tef*), pearl millet (*Pennisetum glaucum*), wheat or other crops. It is a relay crop in rice paddies (Bejiga et al., 2006). The seed harvest can be done manually or mechanically by pulling the plant out. Pods are harvested 90-120 days or 130-180 days from sowing, generally when they turn yellow (Ecocrop, 2013). The harvested plants are dried on the ground down to 12-16% moisture and the seeds separated from the chaff by threshing and winnowing. Under rainfed conditions, seed yields can be lower than 1 t/ha but 2 to 3.5 t/ha have been obtained under irrigation and experimental yields of up to 4-5.5 t/ha have been reported (Ecocrop, 2013; Bejiga et al., 2006; Iliadis, 2001).

When chickpea is cut for fodder, the first cut may occur only 45 days after sowing. However, later cuts tend to result in higher fodder yields than early cuts: in Pakistan, late cut yields of 1.2 and 4.5 t/ha of green forage were reported *vs.* 0.4 and 0.6 t/ha for early cuts in the same years. Cutting chickpea for fodder impairs seed yield (Khan et al., 1999).

Environmental impact

N-fixing legume

Chickpea is a N-fixing legume (up to 100 kg N/ha) often used to restore soil fertility before cereal or oilseed crops. It is used as disease cycle breaker and helps to reduce pesticide and herbicide usage (Ecoport, 2013).

datasheet citation

Heuzé V., Tran G., Boudon A., Bastianelli D., Lebas F., 2015. *Chickpea (Cicer arietinum)*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/319 *Last updated on October 20, 2015, 14:04*

English corrected by Tim Smith (Animal Science consultant) and Hélène Thiollet (AFZ)

Image credits

Sanjay Acharya • Eitan, F. • Forest and Kim Starr • Forest and Kim Starr • Forest and Kim Starr • Eitan, F.

Search Feedipedia Search

Automatic translation

Anglais

Feed categories

All feeds
drilling plants
- Cereal and grass forages
- Legume forages
- Forage trees
- Aquatic plants
- Other forage plants

Plant products/by-products
- Cereal grains and by-products
- Legume seeds and by-products
- Oil plants and by-products
- Fruits and by-products
- Roots, tubers and by-products
- Sugar processing by-products
- Plant oils and fats
- Other plant by-products

Feeds of animal origin
- Animal by-products
- Dairy products/by-products
- Animal fats and oils
- Insects

Other feeds
- Minerals
- Other products

Latin names

Plant and animal families
Plant and animal species

Resources

Broadening horizons
Literature search
Image search
Glossary
External resources
- Literature databases
- Feeds and plants databases
- Organisations & networks
- Books
- Journals

Chickpea (Cicer arietinum)

Description | Nutritional aspects | Nutritional tables | References

Nutritional attributes

Chickpeas

Chickpea seeds are a source of protein (19-25% DM) as well as energy, as they contain large amounts of starch. Desi types contain less starch (about 35% DM) and more fibre (about 10% DM crude fibre) than kabuli types (about 50% DM starch and 4% DM crude fibre). Chickpeas are particularly rich in lysine (6-7% of the protein) but sulphur-containing amino acids and threonine may be deficient for monogastric species. Chickpeas contain non-negligible amounts of lipids (sometimes less than 5% DM).

Chickpea bran (chuni)

Chickpea bran contains less protein than the seed (13-19% DM) but much more fibre (24-30% DM).

Chickpea straw and chickpea pod husks

Chickpea straw contains slightly more protein than a cereal straw (about 5% DM) but remains a fibrous forage (30-40% DM as crude fibre). Pod husks have a similar composition, perhaps more fibrous.

Chickpea forage and hay

Even though chickpea forage and hay are occasionally used to feed livestock, information about the nutritive value of these forages is almost inexistent. In 1938 in India, samples of chickpea hay and fresh forage had protein values of 13 and 11% DM and crude fibre values of 35 and 27% DM, respectively (Sen, 1938).

Potential constraints

Antinutritional factors

Chickpeas contain a variety of secondary compounds that can impair nutrient absorption from the gastrointestinal tract (Bampidis et al., 2011). Depending on the variety, chickpea seeds contain variable amounts of trypsin and chymotrypsin inhibitors that may decrease their feed value in pigs and poultry. Reported levels of inhibitors are in the 15-19 TIU/mg range, lower than that of raw soybeans (43–84 TIU/mg). Heat treatments, such as cooking or extrusion, reduce the amount of trypsin and chymotrypsin inhibitors (Bampidis et al., 2011; Batterham et al., 1990; Batterham et al., 1993).

Oxalic acid

Chickpea straw has been reported to have a high content of oxalic acid and to be unpalatable and possibly toxic (Suttie, 2000). However, studies do not confirm this.

tannins

Chickpea pod husks contain a high amount of tannins, from 6 to 8% DM. The tannins-bound substrate of chickpea pod husks seems to be mostly carbohydrates (Sreerangaraju et al., 2000).

ruminants

Chickpea seeds

Chickpea seeds have a relatively high protein and starch content and are mainly used as a concentrate, replacing soybean meal and cereal grains. The antinutritional factors in chickpea seeds were inactivated by 12-24 h of *in vitro* incubation with rumen liquor, and subsequently did not have a substantive effect on nutrient absorption from the small intestine of sheep (Bampidis et al., 2011).

Digestibility and rumen degradability

In sheep, estimates of OM digestibility of chickpeas were comprised between 84% (Hadjipanayiotou et al., 1985) and 92% (Bampidis et al., 2011), while energy and protein digestibility were both about 79% (Hadjipanayiotou et al., 1985). Replacing soybean meal and cereal grains by chickpea seeds in heifer, steer or lamb diets improved the apparent digestibility of crude protein and crude fat, with no adverse effect on the digestibilities of DM, fibre and energy (Hadjipanayiotou, 2002; Sommerfeldt et al., 1988; Illg et al., 1987). However, no improvement in digestibility was observed when replacing mixtures of maize grain and rapeseed meal, field peas or lentils by chickpeas in steer diets (Gilbery et al., 2007).

In growing heifers, steers and lactating cows, rumen protein degradability increased with the inclusion rate of chickpeas in replacement of soybean meal and cereal grains (Hadsell et al., 1988; Sommerfeldt et al., 1988; Illg et al., 1987). Rumen ammonia, in steers, was reported to increase with the dietary level of chickpeas in place of soybean meal and cereal grain (Gilbery et al., 2007). The effective rumen protein degradability of chickpea is comprised between 59% (ewes) and 75% (non-lactating Holstein cows) (Bampidis et al., 2011).

Lactating ruminants

In lactating cows, chickpeas can be used as a substitute for soybean meal and maize grain up to 50% (DM basis) of the concentrate, or 25% (DM basis) of the whole diet. Milk protein content decreased at higher inclusion rates, though milk yield and milk fat contents increased (+ 1.2 kg milk/d). The increase in milk yield and fat content with high inclusion rates has been attributed to the relatively high fat content of chickpeas (Hadsell et al., 1988). In lactating ewes, no effect of replacing soybean meal and cereal grains with chickpeas, up to 30% (DM basis) of the concentrates, was observed on milk yield, and milk content of fat, protein, lactose and minerals (Christodoulou et al., 2005; Bampidis et al., 2011).

Growing ruminants

In growing cattle, substitution of mixtures of soybean meal, rapeseed meal and cereal grains by chickpeas resulted in higher body weight gains (Illg et al., 1987; Gilbery et al., 2007). In Holstein heifers fed a diet containing 50% of grass hay (DM basis), body weight gain was optimal when chickpeas were included at 25 to 49% of the concentrate (DM basis). Increasing chickpea inclusion rate (from 0% to 75% of concentrate DM) resulted in a linear decrease in DM intake and feed conversion efficiency (Illg et al., 1987).

In lambs and kids, the replacement of soybean meal and cereal grains with chickpeas did not affect body weight gain, intake or feed conversion ratio as long as the inclusion rate of chickpeas did not exceed 42% of the dietary DM (Hadjipanayiotou, 2002; Bampidis et al., 2011). Similarly, partial or total replacement of soybean meal and cereal grains with chickpeas did not affect carcass weight, yield, or the physical and chemical characteristics of the *longissimus dorsi* muscle (Lanza et al., 2003; Christodoulou et al., 2005).

Chickpea straw

Chickpea straw can be used as a ruminant feed (Bampidis et al., 2011). Compared to other straws, chickpea straw has a relatively high nutritive value (*e.g.* ME = 7.7 MJ/kg DM for chickpea straw *vs*. 5.6 for wheat) (Lopez et al., 2004; Lopez et al., 2005; Bampidis et al., 2011), but lower than that of other legume straws (Hadjipanayiotou et al., 1985; Bruno-Soares et al., 2000; Lopez et al., 2005). In sheep, DM, OM, crude protein and energy digestibilities of chickpea straw were 49%, 51%, 20% and 49%, respectively (Hadjipanayiotou et al., 1985; Bampidis et al., 2011). In rams, potential DM and NDF *in sacco* degradability were 45% and 39%, respectively (Bruno-Soares et al., 2000). Fed in a total mixed ration with chaffed dry groundnut forage and concentrate (700:150:150 g/kg of the total mixed ration), chickpea straw supported a BW gain of 0.38-0.42 kg/day in 10-month old camel calves (BW 187-240 kg) (Bampidis et al., 2011).

Chickpea pod husks

Chickpea pod husks contain a large rumen degradable DM fraction, above 94% (Ngwe et al., 2012). In 6-8 month old lambs and wethers, chickpea pod husks included at 10 to 20% of the diet (DM basis) replacing deoiled rice bran, or rice straw, increased the digestibilities of DM, OM, NDF and ADF (Ngwe et al., 2012; Sreerangaraju et al., 2000). A reduction in the digestibility of crude protein when chickpea pod husks were included at 10% DM was reported (Ngwe et al., 2012).

Pigs

Chickpeas, in spite of their trypsin inhibitor content, are a valuable energy and protein source for pigs and are used to replace soybean meal in the diets. They can be fed raw, dehulled, cooked or extruded (Christodoulou et al., 2006b: Singh et al., 2005; Batterham et al., 1993). True ileal digestibility of all amino acids is similar to that of soybeans (full-fat or soybean meal) (Rubio, 2005; Singh et al., 2005). The ileal digestibility of chickpea starch was reported high (85%) in Iberian pigs (Rubio et al., 2005).

Raw chickpeas

Results on the use of raw chickpeas in pigs are contradictory. Inclusion of up to 75% raw chickpeas (from low fibre varieties or dehulled) replacing soybean meal was found to have no adverse effect on daily gain, feed intake and feed efficiency in growing pigs. Furthermore, pigs tolerated the trypsin and chymotrypsin inhibitors of the chickpeas and showed no sign of organ toxicity (Batterham et al., 1993). In another trial, raw chickpeas fed to growing and finishing pigs at 30% of the dietary DM gave a similar body weight gain, feed intake and feed conversion ratio as soybean meal over the whole period (growing and finishing) (Mustafa et al., 2000). Chickpeas included at 10-20%, 26%, and in one study 75% of the diet DM, had no effect on carcass yield, percentage of lean meat and overall meat quality (Pennisi et al., 1994; Batterham et al., 1993; Visitpanich et al., 1985). However, during the growing period, pigs fed 30% raw chickpeas had lower performance (Mustafa et al., 2000). However, in another experiment during the finishing phase, 10% raw chickpeas negatively influenced weight gain and feed conversion ratio compared to the soybean meal diet (Christodoulou et al., 2006b).

Extruded chickpeas

Extruded chickpeas included at up to 30%, in the diets of growing and finishing pigs, fully replaced the soybean meal with positive effects on body weight gain and feed conversion ratio (Christodoulou et al., 2006b), and with no effect on meat quality (Christodoulou et al., 2006d). The positive effect of extrusion may be due to the improved utilization of starch, fat and protein of extruded chickpeas by the pigs (Bampidis et al., 2011).

Poultry

The digestibility and biological value for poultry of chickpea nutrients are high (Brenes et al., 2008; Nalle, 2009). However, due to the presence of antinutritional factors, raw chickpeas have been reported to increase pancreas weight in growth trials, which may indicate some toxicity (Farrell et al., 1999; Viveros et al., 2001).

Broilers

Some experiments in young animals have reported decreased growth when raw chickpeas were introduced at moderate inclusion rates as low as 10% (Brenes et al., 2008; Farrell et al., 1999). In older animals, the inclusion of raw chickpeas led to decreased growth performance and an increased feed conversion ratio when used at rates above 15-20% (Christodoulou et al., 2006a; Viveros et al., 2001). In slow growing organically reared broilers, growth, but not feed efficiency, was degraded by high levels of chickpeas fed without amino acid supplementation (Katogianni et al., 2008)

Treatment of chickpeas has improved animal performance. The positive effect of thermal treatments such as pelleting or autoclaving has been reported by several authors (Farrell et al., 1999; Christodoulou et al., 2006a; Viveros et al., 2001). Extrusion allowed up to 20% chickpeas in diets for young broilers, whereas raw chickpeas reduced performance (Brenes et al., 2008). In turkeys, 20% extruded chickpeas did not reduce performance, and extreme inclusion rates, up to 80% chickpeas resulted in a reduction of only 8% in growth (Christodoulou et al., 2006b).

The recommendation is to limit chickpeas to 5-10% in starter diets and to 10-15% of DM in grower and finisher diets. Higher levels could be used with heat-processed chickpeas.

Layers

Inclusion rates of chickpeas as high as 25 to 40% in layer diets were shown to maintain egg production (Garsen et al., 2007; Perez-Maldonado et al., 1999). However, other experiments showed a trend to lower performance at levels above 20%. Dehulling chickpeas, or applying thermal treatments such as pelleting did not change the laying rate but improved layer body weight (Robinson et al., 2001). When used as a substitute for maize grain, chickpeas may decrease egg yolk color, which has to be considered in feed formulation (Garsen et al., 2007). It can be recommended to use chickpeas at up to 20% in layer diets provided that the diet is well balanced (notably for methionine).

Rabbits

Chickpea seeds can be safely used as a protein source for growing and breeding rabbits (Alicata et al., 1992; Roy et al., 2002). Inclusion levels up to 35% have been tested in a concentrate fed with green forage *ad libitum* (Roy et al., 2002), though inclusion rates of 10 and 20% are more common (Lebas, 1988; Alicata et al., 1991). Due to their low level of fibre, chickpeas have a digestible energy that exceeds rabbit energy requirements, making them an acceptable energy source for rabbit feeding (Lebas, 1988; Nizza et al., 1993).

When chickpeas are included in complete balanced diets, attention should be paid to their low concentration of sulfur-containing amino acids and threonine. Indeed, protein-rich chickpeas (26% DM) only provide 76% and 81% of sulfur-containing amino acids and threonine requirements, respectively (Lebas, 1988). Moreover, the digestibility of chickpea protein is relatively low when compared to other protein sources (such as soybean meal), a situation that accentuates the seed imbalance of available amino acids (Lebas, 1988; Nizza et al., 1993). If that imbalance is not corrected with other protein sources (e.g. cereal grains, wheat bran), chickpea-based diets have a low palatability (Alicata et al., 1991; Moniello et al., 1993).

Fish

With high carbohydrate and fat content, chickpea seeds are potential good sources of energy, and to a lesser extent protein, for fish feeding. However, their trypsin and chymotrypsin inhibitors may impair their feeding value for fish (Tacon, 1993).

Gilted sea bream (*Sparus aurata*)

Chickpeas were used in farmed seabream diets up to 35% without negative effects, replacing other carbohydrate sources and some of fish meal (Adamidou et al., 2011). Chickpea had no immunosuppressive activity on gilted sea bream and was not as effective as field pea in immuno-stimulation (Henry et al., 2012).

European seabass (*Dicentrarchus labrax*)

Feeding chickpeas to European seabass (*Dicentrarchus labrax*) increased nutrient retention time in the gastrointestinal tract. Chickpea had a high apparent digestibility coefficient for fat. Inclusion of chickpeas in fish pellets was reported to improve pellet hardness without modifying water activity within the pellet (Adamidou et al., 2009).

Australian silver perch (*Bidyanus bidyanus*)

Chickpeas were reported to have lower DM and energy digestibilities than other legume grains in the Australian silver perch (*Bidyanus bidyanus*). Dehulling did not improve the protein digestibility (Booth et al., 2001).

datasheet citation

Heuzé V., Tran G., Boudon A., Bastianelli D., Lebas F., 2015. *Chickpea (Cicer arietinum)*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/319 *Last updated on October 20, 2015, 14:04*

English corrected by Tim Smith (Animal Science consultant) and Hélène Thiollet (AFZ)

Image credits

- Sanjay Acharya
- Eitan, F.
- Forest and Kim Starr
- Forest and Kim Starr
- Forest and Kim Starr
- Eitan, F.

Search Feedipedia Search

Automatic translation

Anglais

Feed categories

All feeds
drilling plants
- Cereal and grass forages
- Legume forages
- Forage trees
- Aquatic plants
- Other forage plants

Plant products/by-products
- Cereal grains and by-products
- Legume seeds and by-products
- Oil plants and by-products
- Fruits and by-products
- Roots, tubers and by-products
- Sugar processing by-products
- Plant oils and fats
- Other plant by-products

Feeds of animal origin
- Animal by-products
- Dairy products/by-products
- Animal fats and oils
- Insects

Other feeds
- Minerals
- Other products

Latin names

Plant and animal families
Plant and animal species

Resources

Broadening horizons
Literature search
Image search
Glossary
External resources
- Literature databases
- Feeds and plants databases
- Organisations & networks
- Books
- Journals

Chickpea (Cicer arietinum)

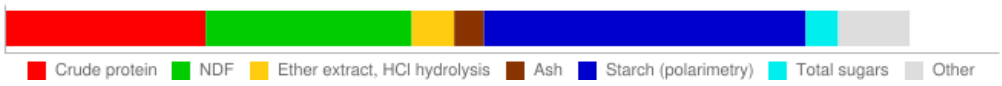
Description | Nutritional aspects | Nutritional tables | References

Tables of chemical composition and nutritional value

- Chickpea seeds, desi type
- Chickpea seeds, kabuli type
- Chickpea bran (chuni)
- Chickpea straw
- Chickpea pod husks

Avg: average or predicted value; SD: standard deviation; Min: minimum value; Max: maximum value; Nb: number of values (samples) used

Chickpea seeds, desi type



Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	89.0	1.0	87.6	91.0	27
Crude protein	% DM	22.1	2.1	18.2	26.5	39
Crude fibre	% DM	10.5	1.1	8.6	12.9	28
NDF	% DM	22.8	4.2	14.1	29.5	19
ADF	% DM	13.8	2.5	7.6	17.6	19
Lignin	% DM	0.7	0.3	0.2	1.3	7
Ether extract	% DM	5.0	1.2	3.3	7.8	34
Ether extract, HCl hydrolysis	% DM	4.7	1.6	2.8	5.7	3
Ash	% DM	3.3	0.3	2.9	4.0	38
Starch (polarimetry)	% DM	35.6	7.6	22.3	47.1	14
Total sugars	% DM	3.6	1.1	1.3	6.3	13
Gross energy	MJ/kg DM	19.6	0.5	17.6	20.0	18 *

Minerals	Unit	Avg	SD	me	Max	Nb
Calcium	g/kg DM	1.7	0.4	1.2	2.6	16
Phosphorus	g/kg DM	3.9	0.6	1.9	4.7	17
Potassium	g/kg DM	11.9	1.1	10.2	13.6	9
Sodium	g/kg DM	0.2	0.1	0.1	0.4	8
Magnesium	g/kg DM	2.1	0.1	1.8	2.3	9
Manganese	mg/kg DM	36				1
Zinc	mg/kg DM	38				1

Amino acids	Unit	Avg	SD	me	Max	Nb
Alanine	% protein	3.7	0.3	3.2	4.3	19
Arginine	% protein	8.6	1.1	7.1	12.3	28
Aspartic acid	% protein	10.6	0.9	9.0	11.9	19
Cystine	% protein	1.2	0.4	0.6	1.8	thirty
Glutamic acid	% protein	17.0	2.7	12.7	20.2	19
wistaria	% protein	3.5	0.3	3.1	4.3	19
Histidine	% protein	2.5	0.2	2.1	3.1	29
Isoleucine	% protein	3.8	0.6	2.6	4.8	29
Leucine	% protein	7.1	0.5	5.9	7.8	29
Lysine	% protein	6.6	0.6	5.4	7.7	31
Methionine	% protein	1.2	0.3	0.7	1.6	31
Phenylalanine	% protein	5.3	0.4	4.4	6.1	29
Proline	% protein	4.0	0.3	3.7	4.5	17
Serine	% protein	4.8	0.3	4.2	5.6	19
Threonine	% protein	3.4	0.2	3.0	4.0	29
Tryptophan	% protein	0.9	0.2	0.7	1.2	8
Tyrosine	% protein	2.2	0.4	1.5	3.2	29
Valine	% protein	3.9	0.5	2.8	4.9	29

Secondary metabolites	Unit	Avg	SD	me	Max	Nb
Tannins (eq. tannic acid)	g/kg DM	3.1	3.9	0.7	7.6	3
Tannins, condensed (eq. catechin)	g/kg DM	4.9		1.2	8.7	2

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
OM digestibility, ruminants	%	90.2				1
Energy digestibility, ruminants	%	88.9				1
OF ruminants	MJ/kg DM	17.4				*
ME ruminants	MJ/kg DM	14.1				*
Nitrogen degradability (effective, k=6%)	%	84				1

Pig nutritive values	Unit	Avg	SD	me	Max	Nb
Energy digestibility, growing pig	%	75.5	2.8	72.1	81.3	9
DE growing pig	MJ/kg DM	14.6	0.7	13.9	16.3	9
MEn growing pig	MJ/kg DM	13.9				*
DO growing pig	MJ/kg DM	10.0				*
Nitrogen digestibility, growing pig	%	79.4	3.1	74.7	83.5	8

Poultry nutritive values	Unit	Avg	SD	me	Max	Nb
AME poultry	MJ/kg DM	12.7	0.8	11.5	13.2	5

The asterisk * indicates that the average value was obtained by an equation.

References

Abreu et al., 1998 ; AFZ, 2011 ; Allan et al., 2000 ; Brenes et al., 2008 ; CIRAD 1991 ; Dewar, 1967 ; Faurie et al., 1992 ; Gilbery et al., 2007 ; Lim Han Kuo 1967 ; Perez-Maldonado et al., 1999 ; Portugal et al., 1990 ; Ravindran et al., 1994 ; Robinson et al., 2001 ; Rossi et al., 1984 ; Salgado et al., 2001 ; Sen, 1938 ; Thacker et al., 2002 ; Tiwari et al., 2006 ; Visitpanich et al., 1985 ; Viveros et al., 2001 ; Wiryawan 1997

Last updated on 04/09/2013 00:45:07

Chickpea seeds, kabuli type

Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	89.0	0.9	87.6	90.8	87
Crude protein	% DM	22.3	1.6	18.8	25.7	102
Crude fibre	% DM	3.9	0.4	3.1	5.1	85
NDF	% DM	11.2	2.4	8.0	17.3	71
ADF	% DM	4.4	0.6	3.6	6.1	70
Lignin	% DM	0.2	0.1	0.0	0.5	52
Ether extract	% DM	6.4	1.0	5.1	8.0	41
Ether extract, HCl hydrolysis	% DM	6.7	0.4	6.0	7.3	47
Ash	% DM	3.5	1.1	3.0	13.9	99
Starch (polarimetry)	% DM	50.1	1.5	46.9	53.3	57
Total sugars	% DM	6.0	1.7	2.6	8.0	18
Gross energy	MJ/kg DM	19.6	0.7	18.3	21.7	16 *

Minerals	Unit	Avg	SD	me	Max	Nb
Calcium	g/kg DM	1.4	0.2	1.1	1.8	18
Phosphorus	g/kg DM	4.2	0.5	3.3	5.0	18
Potassium	g/kg DM	11.7	3.1	1.3	14.3	16
Sodium	g/kg DM	0.2	0.1	0.1	0.4	14
Magnesium	g/kg DM	1.5	0.2	1.1	1.8	18
Manganese	mg/kg DM	35	11	18	43	6
Zinc	mg/kg DM	38	13	21	50	7
Copper	mg/kg DM	8	3	2	10	7
Iron	mg/kg DM	93	35	55	154	7

Amino acids	Unit	Avg	SD	me	Max	Nb
Alanine	% protein	4.0	0.5	3.6	5.1	18
Arginine	% protein	8.5	0.8	7.1	10.2	28
Aspartic acid	% protein	11.6	0.9	10.2	13.1	18
Cystine	% protein	1.5	0.7	0.7	3.4	25
Glutamic acid	% protein	18.4	2.0	15.4	21.0	19
wistaria	% protein	3.6	0.4	3.2	4.3	18
Histidine	% protein	2.6	0.2	2.3	3.1	29

Isoleucine	% protein	4.0	0.5	3.0	4.4	29
Leucine	% protein	7.4	0.3	7.0	8.0	29
Lysine	% protein	6.8	0.3	6.1	7.2	31
Methionine	% protein	1.2	0.3	0.8	1.7	28
Phenylalanine	% protein	5.6	0.3	4.9	6.1	27
Proline	% protein	4.3	0.6	3.8	5.8	18
Serine	% protein	4.9	0.2	4.7	5.3	18
Threonine	% protein	3.6	0.2	3.1	4.0	29
Tryptophan	% protein	0.9	0.3	0.6	1.4	7
Tyrosine	% protein	2.4	0.5	1.6	3.3	27
Valine	% protein	4.2	0.4	3.2	4.8	29

Secondary metabolites	Unit	Avg	SD	me	Max	Nb
Tannins (eq. tannic acid)	g/kg DM	2.1	2.5	0.0	6.2	5
Tannins, condensed (eq. catechin)	g/kg DM	0.0				1

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
OM digestibility, ruminants	%	88.1		84.0	92.1	2
Energy digestibility, ruminants	%	85.1		79.0	91.2	2
OF ruminants	MJ/kg DM	16.7		15.0	17.6	2 *
ME ruminants	MJ/kg DM	13.6				*
Nitrogen digestibility, ruminants	%	79.0				1
Nitrogen degradability (effective, k=6%)	%	93	3	88	95	4

Pig nutritive values	Unit	Avg	SD	me	Max	Nb
Energy digestibility, growing pig	%	83.8	4.1	73.3	89.4	13
DE growing pig	MJ/kg DM	16.4	0.6	15.5	17.6	13 *
MEn growing pig	MJ/kg DM	15.8				*
DO growing pig	MJ/kg DM	11.9				*
Nitrogen digestibility, growing pig	%	82.3	4.1	75.1	86.9	11

The asterisk * indicates that the average value was obtained by an equation.

References

Abreu et al., 1998 ; Abu-Shakra et al., 1970 ; AFZ, 2011 ; Alicata et al., 1992 ; Christodoulou et al., 2005 ; Christodoulou et al., 2006 ; CIRAD 1991 ; Combe et al., 1991 ; Faurie et al., 1992 ; Hadjipanayiotou et al., 1985 ; Hadjipanayiotou 2002 ; Harmuth-Hoene et al., 1987 ; IIlg et al., 1987 ; Kande 1967 ; Lebas, 1988 ; Nalle, 2009 ; Pennisi et al., 1994 ; Portugal et al., 1990 ; Rossi et al., 1984 ; Salgado et al., 2001 ; Thacker et al., 2002 ; Visitpanich et al., 1985 ; Viveros et al., 2001 ; Wiryawan 1997

Last updated on 04/09/2013 00:46:31

Chickpea bran (chuni)

Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	89.7		88.4	91.0	2
Crude protein	% DM	15.6	3.0	12.5	18.5	3
Crude fibre	% DM	27.7		24.3	31.1	2
NDF	% DM	43.0				*
ADF	% DM	35.3				*
Ether extract	% DM	3.5		2.8	4.2	2
Ash	% DM	6.1		5.1	7.0	2
Gross energy	MJ/kg DM	19.0				*

Minerals	Unit	Avg	SD	me	Max	Nb
Calcium	g/kg DM	10.4	4.6	6.7	15.6	3
Phosphorus	g/kg DM	3.0	0.2	2.7	3.2	3

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
OM digestibility, ruminants	%	59.6				1
Energy digestibility, ruminants	%	57.3				*
OF ruminants	MJ/kg DM	10.9				*
ME ruminants	MJ/kg DM	8.7				*
Nitrogen digestibility, ruminants	%	59.4				1

The asterisk * indicates that the average value was obtained by an equation.

References

Jain et al., 1980; Krishna, 1985; Vargas et al., 1965

Last updated on 31/08/2013 16:23:42

Chickpea straw

Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	90.4	1.9	88.7	93.0	4
Crude protein	% DM	5.4	1.8	2.8	8.8	11
Crude fibre	% DM	41.0	7.2	31.4	50.6	5
NDF	% DM	65.6	10.0	46.0	78.0	10
ADF	% DM	46.9	8.2	33.0	59.6	10
Lignin	% DM	11.9	2.7	8.5	15.8	8
Ether extract	% DM	1.0	0.4	0.5	1.6	6
Ash	% DM	7.4	2.7	3.8	13.3	12
Gross energy	MJ/kg DM	18.1		18.1	18.6	2 *

Minerals	Unit	Avg	SD	me	Max	Nb
Calcium	g/kg DM	9.4	4.2	3.4	13.6	5
Phosphorus	g/kg DM	1.6	1.6	0.5	4.4	5
Magnesium	g/kg DM	2.9	1.2	1.8	4.1	3
Manganese	mg/kg DM	10				1
Zinc	mg/kg DM	37		6	68	2
Copper	mg/kg DM	0				1
Iron	mg/kg DM	1500				1

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
OM digestibility, ruminants	%	45.0	8.0	42.7	60.7	4 *
Energy digestibility, ruminants	%	41.4				*
OF ruminants	MJ/kg DM	7.5				*
ME ruminants	MJ/kg DM	6.1				*
ME ruminants (gas production)	MJ/kg DM	6.8		6.5	7.2	2
Nitrogen digestibility, ruminants	%	47.3		40.0	54.6	2

The asterisk * indicates that the average value was obtained by an equation.

References

Abreu et al., 1998 ; Alibes et al., 1990 ; Bruno-Soares et al., 2000 ; Gowda et al., 2004 ; Hadjipanayiotou et al., 1985 ; Lander et al, 1936. ; Lopez et al., 2005 ; Nsahlai et al., 1996 ; Sehu et al., 1998 ; Singh et al., 2011 ; Yaméogo et al. 1991

Last updated on 31/08/2013 16:24:45

Chickpea pod husks

Main analysis	Unit	Avg	SD	me	Max	Nb
Dry matter	% as fed	87.3		86.6	88.0	2
Crude protein	% DM	6.2	3.0	3.5	10.5	4
Crude fibre	% DM	48.4				1
NDF	% DM	67.1	9.7	56.7	76.0	3
ADF	% DM	59.0	10.5	46.9	65.2	3
Lignin	% DM	4.7	1.4	3.3	6.1	3
Ether extract	% DM	1.5	1.0	0.9	3.0	4
Ash	% DM	5.4	1.6	3.8	7.3	4
Gross energy	MJ/kg DM	18.9				*

Secondary metabolites	Unit	Avg	SD	me	Max	Nb
Tannins, condensed (eq. catechin)	g/kg DM	84.0				1

Ruminant nutritive values	Unit	Avg	SD	me	Max	Nb
ME ruminants (gas production)	MJ/kg DM	8.6				1

The asterisk * indicates that the average value was obtained by an equation.

References

Ngwe et al, 2012. ; Sen, 1938 ; Sreerangajaru et al., 2000

Last updated on 04/09/2013 00:37:30

datasheet citation

Heuzé V., Tran G., Boudon A., Bastianelli D., Lebas F., 2015. *Chickpea (Cicer arietinum)*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/319 *Last updated on October 20, 2015, 14:04*

English corrected by Tim Smith (Animal Science consultant) and Hélène Thiollet (AFZ)

Image credits

- Sanjay Acharya
- Eitan, F.
- Forest and Kim Starr
- Forest and Kim Starr
- Forest and Kim Starr
- Eitan, F.

Search Feedipedia Search

Automatic translation
Anglais

Feed categories
All feeds
drilling plants
- Cereal and grass forages
- Legume forages
- Forage trees
- Aquatic plants
- Other forage plants

Plant products/by-products
- Cereal grains and by-products
- Legume seeds and by-products
- Oil plants and by-products
- Fruits and by-products
- Roots, tubers and by-products
- Sugar processing by-products
- Plant oils and fats
- Other plant by-products

Feeds of animal origin
- Animal by-products
- Dairy products/by-products
- Animal fats and oils
- Insects

Other feeds
- Minerals
- Other products

Latin names
Plant and animal families
Plant and animal species

Resources
Broadening horizons
Literature search
Image search
Glossary
External resources
- Literature databases
- Feeds and plants databases
- Organisations & networks
- Books
- Journals

Chickpea (Cicer arietinum)

Description | Nutritional aspects | Nutritional tables | References

References

Abdel-Magid, S. S. ; El-Rahman, H. H. A. ; Mohamed, M. I. ; Awadalla, I. M., 2008. Utilization of chick pea straw and pea straw in feeding growing Rahmani lambs. Am.-Eur. J. Sci. Res., 4 (2): 214-217

Abreu, J. M. F. ; Bruno-Soares, A. M., 1998. Chemical composition, organic matter digestibility and gas production of nine legume grains. Anim. Feed Sci. Technol., 70 (1-2): 49-57

Abu-Shakra, S. ; Mirza, S. ; Tannous, R., 1970. Chemical composition and amino acid content of chickpea seeds at different stages of developpement. J. Sci. Food Agric., 21 (2): 91-93

Adamidou, S.; Nengas, I.; Alexis, M.; Foundoulaki, E.; Nikolopoulou, D.; Campbell, P.; Karacostas, I.; Rigos, G.; Bella, GJ; Jauncey, K., 2009. Apparent nutrient digestibility and gastrointestinal evacuation time-In European seabass (*Dicentrarchus labrax*) fed diets containing different levels of legumes. Aquaculture, 289 (1-2): 106-112

Adamidou, S. ; Nengas, I. ; Henry, M. ; Midoy, N. I. ; Rigos, G. ; Bell, G. J. ; Jauncey, K., 2011. Effects of dietary inclusion of peas, chickpeas and faba beans on growth, feed utilization and health of gilthead seabream (*Sparus aurata*). Aquacult. Nutr., 17 (2): e288-e296

Akande, K. E. ; Doma, U. D. ; Agu, H. O. ; Adamu, H. M., 2010. Major antinutrients found in plant protein sources: their effect on nutrition. Pakistan J. Nutr., 9 (8): 827-832

Alicata, M. L. ; Bonanno, A. ; Leto, G. ; Giaccone, P. ; Alabiso, M., 1991. Chickpeas in the feeding of rabbits. Revista di Coniglicoltura, 28 (5) : 53-56

Alicata, M. L. ; Bonanno, A. ; Alabiso, M. ; Portolano, B. ; Stimolo, M. C., 1992. Further trials on the use of chick-peas in growing rabbit feeding. J. Appl. Rabbit Res., 15 (B): 1025-1932, 5th World Rabbit Congress, Oregon

Allan, G. L. ; Parkinson, S. ; Booth, M. A. ; Stone, D. A. J. ; Rowland, S. J. ; Frances, J. ; Warner-Smith, R., 2000. Replacement of fish meal in diets for Australian silver perch, *Bidyanus bidyanus*: I. Digestibility of alternative ingredients. Aquaculture, 186 (3-4): 293-310

Bampidis, V. A. ; Christodoulou, V. ; Nistor, E., Skapetas, B. ; Nistor, G. H., 2009. The use of chickpeas (*Cicer arietinum*) in poultry diets: a review. Lucrări ştiinţifice Zootehnieşi Biotehnologii, 42 (1): 323-330

Bampidis, V. A. ; Christodoulou, V., 2011. Chickpeas (*Cicer arietinum* L.) in animal nutrition: A review. Anim. Feed Sci. Technol., 168 (1-2): 1-20

Batterham, E. S. ; Andersen, L. M. ; Saini, H. S. ; Baigent, D. R., 1990. Tolerance of growing pigs to trypsin and chymotrypsin inhibitors in chickpea (*Cicer arietinum*) and pigeon pea (*Cajanus cajan*) meals. Proc. Austr. Soc. Anim. Prod., 18: 453

Batterham, E. S. ; Saini, H. S. ; Andersen, L. M. ; Baigent, R. D., 1993. Tolerance of growing pigs to trypsin and chymotrypsin inhibitors in chickpeas (*Cicer arietinum*) and pigeonpeas (*Cajanus cajan*). J. Sci. Food Agric., 61 (2): 211-216

Bejiga, G.; van der Maesen, L. J. G., 2006. *Cicer arietinum* L.. Record from Protabase. Brink, M. & Belay, G. (Editors). PROTA (Plant Resources of Tropical Africa / Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands

Booth, M. A. ; Allan, G. L. ; Frances, J. ; Parkinson, S., 2001. Replacement of fish meal in diets for Australian silver perch, *Bidyanus bidyanus*. IV. Effects of dehulling and protein concentration on digestibility of grain legumes. Aquaculture, 196 (1-2): 67-85

Brenes, A. ; Viveros, A. ; Centeno, C. ; Arija, I. ; Marzo, F., 2008. Nutritional value of raw and extruded chickpeas (*Cicer arietinum* L.) for growing chickens. Spanish J. Agric. Res., 6 (4), 537-545

Bruno-Soares, A. M. ; Abreu, J. M. F. ; Guedes, C. V. M. ; Dias-da-Silva, A. A., 2000. Chemical composition, DM and NDF degradation kinetics in rumen of seven legume straws. Anim. Feed Sci. Technol., 83 (1): 75-80

Christodoulou, V. ; Bampidis, V. A. ; Hucko, B. ; Ploumi, K. ; Iliadis, C. ; Robinson, P. H. ; Mudrik, Z., 2005. Nutritional value of chickpeas in rations of lactating ewes and growing lambs. Anim. Feed Sci. Technol., 118 (3-4): 229-241

Christodoulou, V. ; Bampidis, V. A. ; Hucko, B. ; Iliadis, C. ; Mudrik, Z., 2006. Nutritional value of chickpeas in rations of broiler chickens. Arch. Geflügelk., 70 (3): 112–118

Christodoulou, V. ; Bampidis, V. A. ; Sossidou, E. ; Ambrosiadis, J. ; Hucko, B. ; Iliadis, C. ; Kodes, A., 2006. The use of extruded chickpeas in diets for growing-finishing pigs. Czech J. Anim. Sci., 51 (8): 334-342

Christodoulou, V. ; Bampidis, V.A.; Hučko, B.; Mudřik, Z., 2006. The use of extruded chickpeas in diets of broiler turkeys. Czech J. Anim. Sci., 51 (9): 416-423

Christodoulou, V. ; Ambrosiadis, J. ; Sossidou, E. ; Bampidis, V. ; Arkoudilos, J. ; Hucko, B. ; Iliadis, C., 2006. Effect of replacing soybean meal by extruded chickpeas in the diets of growing-finishing pigs on meat quality. Meat Science, 73 (3): 529-535

Christodoulou, V. ; Bampidis, V. A. ; Labrinea, E. ; Ambrosiadis, J. ; Arkoudelos, J. ; Hučko, B., 2009. Effect of dietary extruded chickpea supplementation on meat quality of broiler turkeys. EAAP 2009 – 60th Annual Meeting of the European Federation of Animal Science, Barcelona, Spain, 24-27 August 2009

Ecocrop, 2013. Ecocrop database. FAO, Rome, Italy

Ecoport, 2013. Ecoport database. Ecoport

FAO, 2013. FAOSTAT. Food and Agriculture Organization of the United Nations

Farrell, D. J. ; Perez-Maldonado, R. A. ; Mannion, P. F., 1999. Optimum inclusion of field peas, faba beans, chick peas and sweet lupins in poultry diets. II. Broiler experiments. Br. Poult. Sci., 40 (5): 674-680

Garsen, A. ; Dotas, D. ; Florou-Paneri, P. ; Nikolakakis, I., 2007. Performance and egg quality traits of layers fed diets containing increasing levels of chickpea. Epitheorese zootechnikes Epistemes (Animal Science Reviews), 36: 3-14

Gilbery, T. C.; Lardy, G. P.; Soto-Navarro, S. A.; Bauer, M. L.; Anderson, V. L., 2007. Effect of field peas, chickpeas and lentils on rumen fermentation, digestion and microbial protein synthesis in receiving diets for beef cattle. J. Anim. Sci., 85 (11): 3045-3053

Hadjipanayiotou, M.; Economides, S.; Koumas, A., 1985. Chemical composition, digestibility and energy content of leguminous grain and straws grown in a mediterranean region. Ann. Zootech., 34 (1): 23-30

Hadjipanayiotou, M., 2002. Replacement of soybean meal and barley grain by chickpeas in lamb and kid fattening diets. Anim. Feed Sci. Technol., 96 (1/2): 103-109

Hadsell, D. L. ; Sommerfeldt, J. L., 1988. Chickpeas as a protein and energy supplement for high producing dairy cows. J. Dairy Sci., 71 (3): 762-772

Henry, M. A. ; Nikolopoulou, D. ; Alexis, M. N., 2012. *In vitro* effect of peas, *Pisum pisum*, and chickpeas, Cicer *arietinum*, on the immune system of gilthead seabream, *Sparus aurata*. In Vitro Cell. & Dev. Biol.-Animal, 48 (7): 407-412

ICRISAT, 2013. Chickpea (*Cicer arietinum* L.). ICRISAT

Iliadis, C., 2001. Evaluation of six chickpea varieties for seed yield under autumn and spring sowing. J. Agric. Sci., 137 (4): 439–444

Illg, D. J. ; Sommerfeldt, J. L. ; Boe, A. A., 1987. Chickpeas as a substitute for corn and soybean meal in growing heifer diets. J. Dairy Sci., 70 (10): 2181-2185

Katogianni, I.; Zoiopoulos, P. E.; Adamidis, C.; Fegeros, K., 2008. Substituting chickpeas for soybeans in diets for broilers fattened according to the European Community organic regime. Arch. Geflügelk., 72 (4): 152–156

Khan, N. A. ; Baker, B. E., 1957. The amino-acid composition of some pakistani pulses. J. Sci. Food Agric., 8: 301-305

Khan, R. U.; Rashid, A.; Khan, A., 1999. Effect of cutting chickpea at different dates on green fodder and seed yield under rainfed condition. Pakistan J. Biol. Sci., 2 (2): 347-349

Lander, P. E. ; Dharmani, L. C., 1936. Some digestibility trials on Indian feeding stuffs. Part X. Green fodders, hays and gram. Indian J. Vet. Sci., 6: 117-127

Lanza, M.; Bella, M.; Barbagallo, D.; Fasone, V.; Finocchiaro, L.; Priolo, L., 2003. Effect of partially or totally replacing soybean meal and maize by chickpeas (*Cicer arietinum* L.) in lamb diets: growth performances, carcass and meat quality. Anim. Res., 52 (3): 263-270

Lebas, F., 1988. First attempt to study chick-peas utilization in growing rabbit feeding. 4th World Rabbit Congress, Budapest, 2 : 244-248

Lim Han Kuo, 1967. Animal feeding stuffs. Part 3. Compositional data of feeds and concentrates. Malay. Agric. J., 46 (1): 63-79

Lopez, S.; Prieto, M.; Dijkstra, J., Dhanoa, M. S.; France, J., 2004. Statistical evaluation of mathematical models for microbial growth. Int. J. Food Microbiol., 96 (3): 289-300

Lopez, S. ; Davies, D. R. ; Giraldez, F. J. ; Dhanoa, M. S. ; Dijkstra, J. ; France, J., 2005. Assessment of nutritive value of cereal and legume straws based on chemical composition and *in vitro* digestibility. J. Sci. Food Agric., 85 (9): 1550-1557

Moniello, G. ; Nizza, A. ; Guida, R. ; Ferrara, B., 1993. Utilization of different proteic feeds to formulate concentrates for rabbits. 2: *In vivo* observations. Atti della Societa Italiana delle Scienze Veterinarie, 47 (3) : 2131-2135

Mustafa, A. F. ; Thacker, P. A. ; McKinnon, J. J. ; Christensen, D. A. ; Racz, V. J., 2000. Nutritional value of feed grade chickpeas for ruminants and pigs. J. Sci. Food Agric., 80 (11): 1581-1588

Nalle, C. L., 2009. Nutritional evaluation of grain legumes for poultry. PhD Thesis, Massey University, Palmerston North, New Zealand

Ngwe, T.; Nukui, Y.; Oyaizu, S.; Takamoto, G.; Koike, S.; Ueda, K.; Nakatsuji, H.; Kondo, S.; Kobayashi, Y., 2012. Bean husks as a supplemental fiber for ruminants:... Potential use for activation of fibrolytic rumen bacteria to improve main forage digestion Anim Sci J., 83 (1): 43-49

Nizza, A. ; Moniello, G. ; Di-Lella, T., 1993. Utilization of different proteic feeds to formulate concentrates for rabbits. 1: Apparent digestibility and nitrogen balance. Atti della Societa Italiana delle Scienze Veterinarie, 47 (3) : 2125-2129

Ørskov, E. R. ; Nakashima, Y. ; Abreu, J. M. F. ; Kibon, A. ; Tuah, A. K., 1992. Data on DM degradability of feedstuffs. Studies at and in association with the Rowett Research Organization, Bucksburn, Aberdeen, UK. Personal Communication

Pennisi, P .; Bosi, P .; Avondo, M .; D'Urso, G., 1994. Evidence of use of chickpea (*Cicer arietinum* L.) in the lean pork. Of Pig Breeding magazine, 10: 61-64

Perez-Maldonado, R. A. ; Mannion, P. F. ; Farrell, D.J., 1999. Optimum inclusion of field peas, faba beans, chick peas and sweet lupins in poultry diets. I. Chemical composition and layer experiments. Br. Poult. Sci., 40 (5): 667-673

Portugal Melo, I. M. ; Ramalho Ribeiro, J. M. C., 1990. Composition and nutritive value of chickpea. In: Saxena M.C., Cubero J.I., Wery J. (eds.). Present status and future prospects of chickpea crop production and improvement in the Mediterranean countries Zaragoza : CIHEAM, Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 9: 107-111

Ravindran, G.; Ravindran, V.; Bryden, W. L., 2006. Total and ileal digestible tryptophan contents of feedstuffs for broiler chickens. J. Sci. Food Agric., 86 (7): 1132-1137

Robinson, D. ; Singh, D. N., 2001. Alternative protein sources for laying hens. RIRDC publication 00/144. Rural Industries Research and Development Corporation, Kingston ACT, Australia. 85pp.

Rossi, M. ; Germondari, I. ; Casini, P., 1984. Comparison of chickpea cultivars : chemical composition, nutritional evaluation, and oligosaccharide content. J. Agric. Food Chem., 32 (4): 811-814

Roy, J. ; Sultana, N. ; Khondoker, Z. ; Reza, A. ; Hossain, S. M. J., 2002. Effect of different sources of protein on growth and reproductive performances of rabbits. Pakistan J. Nutr., 1 (6) : 279-281

Rubio, L. A.; Pedrosa, M. M.; Perez, A.; Cuadrado, C.; Burbano, C.; Muzquiz, M., 2005. Ileal digestibility of defatted soybean, lupin and chickpea seed meals in cannulated Iberian pigs: II. Fatty acids and carbohydrates. J. Sci. Food Agric., 85 (8): 1322-1328

Rubio, L. A., 2005. Ileal digestibility of defatted soybean, lupin and chickpea seed meals in cannulated Iberian pigs: I. Proteins. J. Sci. Food Agric., 85 (8): 1313-1321

Salgado, P. ; Lalles, J. P. ; Toullec, R. ; Mourato, M. ; Cabral, F. ; Freire, J. P. B., 2001. Nutrient digestibility of chickpea

(*Cicer arietinum* L.) seeds and effects on the small intestine of weaned piglets. Anim. Feed Sci. Technol., 91 (3/4): 197-212

Salgado, P.; Freire, J. P. B.; Ferreira, R. B.; Teixeira, A.; Bento, O.; Abreu, M. C.; Toullec, R.; Lalles, J. P., 2003. Immunodetection of legume proteins resistant to small intestinal digestion in weaned piglets. J. Sci. Food Agric., 83 (15): 1571-1580

Sen, K. C., 1938. The nutritive values of Indian cattle feeds and the feeding of animals. Indian Council of Agricultural Research, New Dehli, Bulletin No. 25, 1-30

Singh, D. N. ; Barneveld, R. J. van ; Ru, Y. J., 2005. Digestibility of amino acids and energy in mung bean, chickpea and lablab when fed to pigs. In: Paterson, J. E. (Ed.) Manipulating pig production X. Proc. 10th Bienn. Conf. Austral. Pig Sci. Assoc., Christchurch, New Zealand, 27-30/11/2005: 268

SMA, 2008. Beef cow rations and winter feeding guidelines. Saskatchewan Ministry of Agriculture, Production factsheet

Sommerfeldt, J. L.; Lyon, K. A., 1988. Ration digestibilities and ruminal characteristics in steers fed chickpeas 1. J. Dairy Sci., 71 (3): 843-847

Sreerangaraju, G. ; Krishnamoorthy, U. ; Kailas, M. M., 2000. Evaluation of Bengal gram (*Cicer arietinum*) husk as a source of tannin and its interference in rumen and post-rumen nutrient digestion in sheep. Anim. Feed Sci. Technol., 85 (1-2): 131-138

Suttie, J. M., 2000. Hay and straw conservation for small-scale farming and pastoral conditions. FAO Plant Production and Protection Series No. 29, FAO, Rome

Tacon, A. G. J., 1993. Feed formulation and on-farm feed management. In M.B. New, A.G.J. Tacon and I. Csavas, eds. Farm-made aquafeeds, p. 61-74. Proceedings of the FAO/AADCP Regional Expert Consultation on Farm-Made Aquafeeds. Bangkok, FAO-RAPA/AADCP

Taylor, W. J.; Ford, R., 2007. Chickpea. In: Chittarajan, K., Genome Mapping and Molecular Breeding in Plants, 3 (6): 109-122

Thacker, P. A. ; Qiao ShiYan ; Racz, V. J., 2002. A comparison of the nutrient digestibility of Desi and Kabuli chickpeas fed to swine. J. Sci. Food Agric., 82 (11): 1312-1318

Tiwari, M. R. ; Khanal, S. ; Shrestha, B. ; Jha, R. K., 2006. Nutritional variation of different feed ingredients and compound feed found in different parts of Nepal. Nepal Agric. Res. J., 7: 75-81

van der Maesen, L. J. G., 1989. *Cicer arietinum* L.. Record from Proseabase. van der Maesen, L. J. G.; Somaatmadja, S. (Eds). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia

Vargas, M .; Urba, R .; January, R .; Báez, H .; Pardo, P .; Visconti, C., 1965. Composition of Chilean food use in livestock and poultry. Santiago. Minister of Agriculture. Veterinary Research Institute.

Visitpanich, T. ; Batterham, E. S. ; Norton, B. W., 1985. Nutritional value of chickpea (*Cicer arietinum*) and pigeonpea (*Cajanus cajan*) meals for growing pigs and rats. I. Energy content and protein quality. Aust. J. Agric. Res., 36 (2): 327-335

Viveros, A. ; Brenes, A. ; Elices, R. ; Arija, I. ; Canales, R., 2001. Nutritional value of raw and autoclaved kabuli and desi chickpeas (*Cicer arietinum* L.) for growing chickens. Br. Poult. Sci., 42 (2): 242-251

Wiryawan, K. G. ; Dingle, J. G. ; Kumar, A. ; Gaughan, J. B. ; Young, B. A., 1995. True metabolisable energy content of grain legumes : effects of enzyme supplementation. In: Rowe, J.B., Nolan, J.V. (Eds.), Recent Advances in Animal Nutrition in Australia. University of New England, Armidale. p. 196

Wiryawan, K. G., 1997. New vegetable protein for layers. Final report for project UQ-21E, Department of Animal Production, University of Queensland

Woodman, H. E., 1945. The composition and nutritive value of feeding stuffs. United Kingdom. Ministry of Agriculture, Fisheries and Food. Bulletin No. 124

79 references found

datasheet citation

Heuzé V., Tran G., Boudon A., Bastianelli D., Lebas F., 2015. *Chickpea (Cicer arietinum)*. Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. http://www.feedipedia.org/node/319 *Last updated on October 20, 2015, 14:04*

English corrected by Tim Smith (Animal Science consultant) and Hélène Thiollet (AFZ)

Image credits

- Sanjay Acharya
- Eitan, F.
- Forest and Kim Starr
- Forest and Kim Starr
- Forest and Kim Starr
- Eitan, F.